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AUTHOR Brandt, Mary E.; And Others
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ABSTRACT

The present study is a replication of a Lahey and Drabman study (1974) which investigated the effects of contingent versus noncontingent reinforcement on the learning of sight words. The subjects in this study were 14 Kamehameha Early Education Program (KEEP) students who composed the lowest reading group in a combined first-second grade classroom. Previous research had shown contingent reinforcement to be effective with slow learners. However, contrary to Lahey and Drabman's findings, no differences were found between the group receiving contingent (token) reinforcement and the group receiving noncontingent reinforcement (no token). The results are explained in terms of the reinforcement histories of the children. That is, previous experience with reinforcement may have faciliated generalization of learning behavior to the task for both groups, and/or the noncontingent reward group interpreted the reward to be contingent on their performance. (Author)

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The Effect of Contingent Reinforcement on the Acquisition of Sight Vocabulary

Technical Report #49

Mary E. Brandt Kathryn H. Au Gisela E. Speidel

The Kamehameha Early Education Program

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The Kamehameha Early Education Program

The Kamehameha Early Education Program (KEEP) is a research and development program of The Kamehameha Schools/Bernice P. Bishop Estate. The mission of KEEP is the development, demonstration, and dissemination of methods for improving the education of Hawaiian and Part-Hawaiian children. These activities are conducted at the Ka Na'i Pono Research and Demonstration School, and in public classrooms in cooperation with the State Department of Education. KEEP projects and activities involve many aspects of the educational process, including teacher training, curriculum development, and child motivation, language, and cognition. More detailed descriptions of KEEP's history and operations are presented in Technical Reports #1-4.

Technical Report #49

The Effect of Contingent Reinforcement on the Acquisition of Sight Vocabulary*

Mary E. Brandt Kathryn H. Au Gisela E. Speidel

Several studies have shown that contingent reinforcement facilitates the acquisition of reading responses (Staats and Butterfield, 1965; Staats, Finley, Minke, and Wolf, 1964; Whitlock and Bushell, 1967; McLaughlin and Lane, 1975). Recently, a study by Lahey and Drabman (1974) found contingent, as opposed to noncontingent reinforcement, produced significantly better learning of sight vocabulary.

The present study was designed to replicate that of Lahey and Drabman, with adjustments made so that the task would be suited to the subjects' level of reading achievement. The purpose of the study was to determine whether the use of contingent (token) reinforcement would significantly increase the rate at which low achievers in reading would learn new sight vocabulary.

Method

Subjects

The subjects were 14 students in the lowest reading group in a combined first and second grade classroom. Their Spring, 1975, mean Full-scale WISC IQ was 89.61 (N=13) with a standard deviation of 15.01. Twelve of these students were first graders; the remaining two were second graders. All of the subjects had experienced in-classroom contingent token and verbal reinforcement in academic, social, and work skill areas since their enrollment in

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*Linda Kobayashi's assistance is gratefully acknowledged.

KEEP (mean number school months=10.6), and had served as subjects in at least one reinforcement study prior to the present one.

All of the subjects are from low income families and are of Polynesian or mixed Polynesian ancestry. (For a full description of KEEP's student population, see Technical Report #13.)

Subjects were randomly assigned to one of the two conditions since the results of a previous study had showed that there was no significant correlation between Full Scale or Verbal IQ and rate of learning phoneme-grapheme correspondences within the range of intelligence of this group. The mean age of the control and experimental subjects was 82.4 months with a range of 75 to 94 months and 83.6 months with a range of 79 to 94 months, respectively. The seven subjects (five males and two females) in the control condition were yoked to the seven subjects (four males and three females) regarding the amount of reinforcement received.

Materials

Fifteen words from the basic word list compiled by Stone and Bartschi (1968) were selected as stimulus materials. Each word was printed in approximately 2½" high black lower case letters on white 5 x 8 cards. The 15 words were divided into three lists balanced in difficulty with each list consisting of five words. The words selected for the training lists had not been taught to these children before the experiment began. However, classroom instruction in reading continued, and no attempt was made during the data collection to restrict the lessons of the regular classroom teacher. Yet, since all children participated in the regular reading program, no bias for one training condition or the other should have occurred.

Procedure

Acquisition. The children individually participated in three training sessions with each session spaced approximately one week to 10 days apart. In each training session, subjects were presented with one of the three lists of five sight words (see Appendix). The three lists were presented in different orders to different yoked pairs of subjects. All of the subjects were trained to a criterion of one trial without error or 30 presentations of each word, whichever came first. A trial was defined as one presentation of the list of five words. All five words in the list were presented on every acquisition trial. The order of the words presented in each trial was random. If the subject had not reached criterion by the 15th trial, a ten minute break occurred before further acquisition trials were undertaken.

Each of the three acquisition sessions began with a study trial. The experimenter stated, "I will read each word for you first." She then successively held each one of the five sight word cards on the list at table level, approximately 2½ feet in front of the subject. After approximately one second, the experimenter pronounced the word. The next word was then shown to the subject until all five words were shown and pronounced. Following the study trial, she initiated the acquisition trials by stating, "Now you read the words out loud." The subject was shown each of the five sight word cards for approximately 10 seconds or until the subject responded. In the Token group, if the response was correct, the subject was told, "Right," and a token was dropped into a clear plastic cylinder in front of him. If the response was incorrect, the subject was told, "That's ___," and the experimenter said the correct response. If the subject did not respond after four words were presented, the experimenter prompted by saying, "Tell me what this word is." No tokens were given for incorrect responses. This procedure

was repeated until the subject had read all five words on one trial correctly or until the 30th trial was completed. At the end of each acquisition session, the tokens were exchanged for a prize.

The procedure in the No-token group was the same except that tokens were not given for correct responses. Subjects in this group were told that they would receive a prize at the end of the session. Prizes were given of the same preference rating (see following section) as that earned by their yoked partner in the Token group.

Reinforcer selection. Prior to each acquisition session, subjects in both groups rated their preference for four prizes of small toys ranging in price from 29¢ to $2.00. The token exchange rate was individually explained to each subject in the Token condition by the experimenter stating, "Every time you read a word correctly, I'll put a marble in this jar. When you are all finished and the marbles are this high, (she pointed to a colored line labelled "3" drawn on the clear plastic container) you get to keep ___ (third preference toy named). If the marbles are this high (she pointed to a colored line labelled "2"), you can keep ___ (second preference toy named). And if the marbles are this high (she pointed to a colored line labelled "1"), you can keep the one you like best (first preference toy named.)" Approximately 75 tokens were needed to earn the prize chosen first, 50 tokens for the prize chosen second, and 25 tokens for the prize chosen third. This preference procedure, based on the assumption that subjects will choose first the toy they would most like to have, ameliorates the problems inherent in using monetary value or experimenter judgment as the basis for determining which toy is the most desirable to the child (Staats, Minke, Finley, Wolf, and Brooks, 1964). At the end of each acquisition session, each subject in the no-token condition received a prize of the same preference rating as that

earned by his yoked experimental subject. For example, if the experimental subject earned his first preference toy, his yoked control also received his first preference toy.

Retention posttests. A retention test was given individually to each subject in both groups one hour following the completion of each of the three acquisition sessions.[1] The five words on which the subject was trained were presented one at a time in random order, and the subject was asked and given approximately 10 seconds to read each word out loud. No feedback was given for the responses on the retention tests.

Results

A 2 x 3 analysis of variance was conducted on the number of trials to reach criterion, the between subject factor being reinforcement conditions and the within subject factor being training sessions. Since many of the children in the present study did not reach criterion after 30 trials, it was decided to assign a score of 30 to those children who did not reach criterion. No significant effects were found for either the reinforcement condition or for learning session (see Table 1). The mean and standard deviations for number of trials to criterion are shown in Table 2.

A similar analysis of the effects of the two training conditions was conducted on the number of responses correct on the fifth trial of each session. The fifth trial was chosen since some children had already reached criterion at that point, and training for them discontinued. Again, the between subject variable, Token or No-token training, showed no significant effects, and the

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[1] Two day and one week retention tests had originally been included but are not reported here. The results of these tests were considered ambiguous because regular classroom activities may have caused the significant increases found in both groups on the one week retention test.

Table 1

Summary Table: ANOVA of number of trials to criterion

Reinforcement conditions x sessions

Source	SS	df	MS	F	
Between S	2,148.28	13			
A (Groups)	27.52	1	27.52	0.15	
Ss within grps	2,120.76	12	176.73		
Within S	2,001.33	28			
B (Sessions)	384.33	2	192.16	2.90	n.s.
AB	28.04	2	14.02	.21	
BxSs within grps	1,588.95	24	66.20		
Total	4,149.61	41			

Table 2

Means and Standard Deviations for trials to criterion and for number of correct reading responses on the fifth trial for Token and for No-Token reinforcement conditions on each of the three training sessions

Condition		Trials to Criterion			Correct Reading Responses--Trial 5		
		Session I	Session II	Session III	Session I	Session II	Session III
Token	$\bar{X}$	23.42	23.00	18.28	1.85	3.00	3.28
	SD	9.55	7.52	12.71	1.67	0.81	1.25
No-Token	$\bar{X}$	21.71	23.42	14.71	2.28	1.71	3.14
	SD	11.47	10.03	8.75	1.70	1.49	1.21

within subject variable, training sessions, was also nonsignificant (see Table 3). The mean and standard deviations for number of words correct are recorded in Table 2.

Table 3

Summary Table: ANOVA of number of words correct--5th trial
Reinforcement conditions x sessions

Source	SS	df	MS	F
Between S	24.40	13		
A (Groups)	1.16	1	1.16	.60
Ss within grps	23.23	12	1.93	
Within S	62.00	28		
B (Sessions)	9.90	2	4.95	2.54 n.s.
AB	5.33	2	2.66	1.36
B x Ss within grps	46.76	24	1.94	
Total	86.40	41		

Retention

The mean number of words read correctly by the Token and No-token groups is presented in Table 4. A repeated measures analysis of variance computed on the retention data indicated that there were no significant differences between the two training conditions and between the three retention tests.

Since many of the children did not reach criterion, the absolute scores on the retention tests did not always reflect percentage of material retained. Therefore, an actual retention score was obtained for each child for each test by subtracting the score he obtained on the posttest from the score obtained on his last trial and dividing this difference by the score on the last trial.

This ratio was then converted to a percentage score and subtracted from 100. The mean percentage retained by each group on each test is shown in Table 4.

Discussion

The addition of tokens contingent upon correct responding did not appear to increase the rate of learning sight words as measured by the number of words learned correctly on the fifth trial and by the number of trials to reach criterion. A one hour retention test also did not show any difference between the two groups.

These results are contrary to the findings of most studies which investigated the effects of contingent reinforcement on acquisition of reading responses (Staats and Butterfield, 1965; Staats, Finley, Minke, and Wolfe, 1964; Staats, Minke Goodwin, and Landeen, 1967; Heitzman, 1974). However, there is an important difference between those studies and the present study. The studies cited above did not include a noncontingent reward condition to control for effects of reward expectancy. For example, Heitzman compared reading performance of a token condition with a condition receiving neither tokens nor a final reward. Staats and his associates generally included only reinforcement conditions (Staats, Minke, Goodwin, and Landeen, 1967) or different schedules of reinforcement (Staats et al., 1964).

The Lahey and Drabman (1974) investigation, which the present study attempted to replicate, did compare the effects of contingent token administration with effects of noncontingent prizes, and found that not only did the token group reach criterion in significantly fewer trials, but also that the token group retained significantly more sight words on delayed retention tests than did the no-token group.

The study may be criticized on grounds that the number of subjects in each group was small and the performance variability large. It is doubtful,

Table 4

Means and Standard Deviations for number correct on one hour retention tests and for percentage of words retained for each reinforcement condition

Condition		Number Correct--1 hr Retention Test			% words retained from last training trial		
		Session I	Session II	Session III	Session I	Session II	Session III
Token	$\bar{X}$	2.57	3.28	3.28	84.28	78.14	80.00
	SD	1.51	1.11	.95	18.12	17.05	20.00
No-token	$\bar{X}$	2.71	2.85	3.71	85.71	91.42	80.00
	SD	.75	1.21	.75	19.02	10.69	16.32

whether a replication with a larger sample would show any reinforcement effects due to the administration of tokens, as the performance difference between the two groups was minimal. The lack of difference in learning rate between the two groups is surprising because it is with slow learners, such as the children in the present study, that the effectiveness of contingent reinforcement has been demonstrated repeatedly.

However, the findings of the study are congruent with the results of a a similar, unpublished study investigating the reinforcement effects of tokens on the acquisition of initial consonant sounds by this same group of students. The finding that contingent reinforcement did not make a difference in acquisition of a reading skill for these particular subjects in two separate studies mitigates against interpreting the present results as chance findings.

A possible explanation for the discrepant finding may be the classroom reinforcement histories of the particular subjects in the present study. As noted in the Method section, these children have had considerable classroom experience with token and verbal reinforcement, especially for good work and attending behaviors. Possibly, sufficient similarity existed between the method employed in teaching reading in the classroom and the method employed in this study to facilitate transfer of appropriate learning behaviors (such as sitting still, attending to the training stimuli, etc.) to the experimental setting in both groups of subjects.

It is also possible that because of their reinforcement histories, the noncontingent reward group interpreted the reward to be contingent upon their performance so that from a cognitive standpoint there existed little difference between the two groups of children.

In addition, it is conceivable that this group of children had reached a ceiling beyond which reinforcement does not increase learning.

Irrespective in interpretation, the results of the present study suggest

that with children who have had sufficient extensive experience with systematic token and verbal reinforcement, it may be unnecessary to continually dispense tokens to maintain behavior if feedback regarding performance and a final reward are present.

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Appendix

Word Lists

1	2	3
boat	did	my
has	his	of
make	for	have
in	water	know
your	put	house